REMARKS

The Final Office Action mailed on December 5, 2000, and the Advisory Action mailed on February 12, 2001, have been received and reviewed. Claims 1-20 and 32-67, which are currently pending in the application, stand rejected. Claims 1, 7, 12, 32, 39, 45, and 56 have been amended. It is respectfully submitted that these amendments are made without prejudice or disclaimer to the subject matter that was previously cited in each of these claims. New claims 68-71 have been added. Reconsideration of the application is respectfully requested in light of the amendments and remarks presented herein.

Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 4, 8, 11, 13, 17, 20, 52, 55, 60, 64, and 67 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, each of claims 4, 8, 11, 13, 17, 20, 52, 55, 60, 64, and 67 was rejected under the second paragraph of section 112 for reciting "at least one of . . ."

It is respectfully submitted that the language presented in these claims is no less exclusionary than use of the term "comprising . . .", which is certainly an acceptable term, and merely provides for alternative elements, which M.P.E.P. § 2173.05(h) explains, under headings I and II, are also acceptable.

For these reasons, it is respectfully requested that the rejections of claims 4, 8, 11, 13, 17, 20, 52, 55, 60, 64, and 67 under the second paragraph of section 112 be withdrawn.

Rejections Under 35 U.S.C. § 102(e) or 35 U.S.C. § 103(a)

Brown

Claims 1-11 and 32-38 stand rejected under 35 U.S.C. § 102(e) as being anticipated by, or in the alternative, under 35 U.S.C. § 103(a), as obvious over U.S. Patent 5,792,594 to Brown et al. (hereinafter "Brown").

With respect to rejections under 35 U.S.C. § 102, a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Brown discloses a method for repatterning semiconductor dice for use in flip-chip applications, as well as various products of the method. The method disclosed in Brown includes forming a first dielectric polymer layer on an active surface of a semiconductor die, exposing bond pads of the semiconductor die through the first dielectric polymer layer, forming a second dielectric polymer layer over the first dielectric polymer layer, and exposing the bond pad and areas of the first dielectric polymer layer upon which circuit traces are to be carried through the second dielectric polymer layer. The first dielectric polymer layer includes a catalyst. A catalytic metal is also deposited onto the exposed bond pad. The catalyst of the first dielectric polymer layer and the catalytic metal of the exposed bond pad facilitate copper plating of the first dielectric polymer layer and of the bond pad. The exposed portion of each bond pad and the exposed portions of the first dielectric polymer layer are then plated with a metal, such as copper, that has better conductivity properties and is less corrosive than aluminum. Upon patterning the metal plating, conductive lines and contact pads are formed.

In one described example of the resulting semiconductor die, the new contact pad is formed directly above the corresponding bond pad and is separated from the active surface of the semiconductor die by the two dielectric polymer layers. Brown does not disclose that the formed structure is useful for anything other than to produce a precision interconnecting pattern and terminal bump pattern from metals other than aluminum so as to enhance the performance of a semiconductor die. Col. 2, lines 46-49 and 55-57.

Claim 1, as proposed to be amended herein, recites a contact that includes an intermediate conductive layer, an insulator component positioned "so as to at least thermally insulate [a] structure" of the semiconductor device, and an electrically conductive contact layer. The intermediate conductive layer of claim 1 is positioned adjacent to and in electrical communication with the structure, which is located beneath a bond pad-bearing surface of a silicon oxide protective layer of the semiconductor device.

Brown does not disclose, teach, or suggest a contact that includes "an intermediate conductive layer positioned adjacent to and in electrical communication with a structure located beneath a bond pad-bearing surface of a silicon oxide-containing protective layer" of a semiconductor device. Rather, the lower layer of the contact disclosed in Brown is positioned *over* a bond pad and a silicon oxide-containing protective surface of a semiconductor die.

Moreover, the insulator component of the contact of Brown is not positioned so as to thermally insulate an underlying structure of the semiconductor device.

Therefore, Brown neither discloses each and every element of claim 1, as proposed to be amended, nor teaches or suggests each and every claim limitation of claim 1. Accordingly, it is respectfully submitted that claim 1, as proposed to be amended, is neither anticipated nor rendered obvious by Brown.

Claims 2-11 are each allowable, among other reasons, as depending from claim 1, which should be allowed.

Claim 7 is further allowable since Brown does not disclose, teach, or suggest a contact with an intermediate conductive layer that includes "a material having a melting temperature that

is greater than a temperature required to switch a phase change component in electrical communication with the contact between a plurality of states." In fact, Brown does not even suggest that the contact disclosed therein is useful adjacent a structure including a phase change component or that the semiconductor device disclosed therein could even include a phase change component.

Claim 10 is additionally allowable because Brown does not disclose, teach, or suggest a contact with a contact layer that includes "a material having a melting temperature that is greater than a temperature required to switch a phase change component in electrical communication with the contact between a plurality of states." In fact, Brown does not even suggest that the contact disclosed therein is useful adjacent a structure that includes a phase change component or that the semiconductor device disclosed therein could even include a phase change component.

Claim 11 is further allowable since Brown includes no disclosure, teaching, or suggestion of the use of aluminum, refractory metals, or refractory metal nitrides as the contact layer of a contact. Brown only teaches that the repatterned terminals thereof are formed from copper or other conductive materials "other than aluminum". *See, e.g.,* col. 2, lines 55-57.

Independent claim 32, as proposed to be amended herein, recites, among other things, a contact that includes "a contact layer and an intermediate conductive layer which partially contact one another and substantially envelop an insulator component . . ." The contact is "positioned adjacent to a structure located beneath a bond pad-bearing surface of a silicon oxide-containing protective layer of the semiconductor device so as to at least thermally insulate underlying structure." It is understood that, as claim 32 is a product-by-process claim, the only limitations considered by the Office in determining patentability are the product limitations.

With respect to the product limitations of claim 32, it is respectfully submitted that Brown does not disclose, teach, or suggest a contact that is positioned adjacent to a structure located beneath a bond pad-bearing surface of a silicon oxide-containing protective layer of a semiconductor device. Brown also fails to disclose, teach, or suggest that the contact is positioned so as to at least thermally insulate the adjacent structure. Therefore, Brown does not

disclose each and every element of claim 32, as proposed to be amended, or teach or suggest each and every limitation of claim 32, as proposed to be amended. Accordingly, it is respectfully submitted that, under 35 U.S.C. §§ 102(e) and 103(a), independent claim 32, as proposed to be amended, is allowable over Brown.

Claims 33-38 are each allowable, among other reasons, as depending from claim 32, which should be allowed.

Rejections Under 35 U.S.C. § 103(a)

Brown in View of Ovshinsky

Claims 12-20 and 39-67 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Brown in view of U.S. Patent 5,296,716 to Ovshinsky et al. (hereinafter "Ovshinsky").

The teachings of Brown have been summarized herein.

Ovshinsky teaches an electrically erasable programmable memory (EEPROM) that includes memory elements formed from a phase change material. The phase change material has a plurality of electrical conductivity states, depending upon whether the material is in an amorphous state, a crystalline state, or an intermediate state. The state of the material depends upon the amount of energy (e.g., heat) applied to the memory element. Ovshinsky does not recognize heat loss as a problem or disclose contacts or other structures to at least thermally insulate the phase change memory elements of the EEPROM disclosed therein.

Independent claim 12, as proposed to be amended herein, recites a contact for a memory element that includes a phase change component. The contact includes, among other things, an intermediate conductive layer adjacent to and in electrical and thermal communication with the memory element.

Neither Brown nor Ovshinsky, taken alone or in combination, teaches or suggests a contact for a memory that includes an intermediate conductive layer adjacent to and in electrical and thermal communication with a memory element. Rather, Brown teaches a contact pad that is located adjacent to a bond pad, while Ovshinsky teaches that, rather than having contacts adjacent

thereto, the adjacent memory elements are bridged by way of an upper conductor 42. Therefore, it is respectfully submitted that claim 12, as proposed to be amended, is allowable over the combination of Brown and Ovshinsky.

Claims 13-20 are each allowable, among other reasons, as depending from claim 12, which should be allowed.

Independent claim 39, as proposed to be amended herein, recites an electrically erasable programmable memory device that includes, among other things, a memory element and a contact. The memory element includes at least one of an electrode and a memory cell that comprises a phase change material. The contact includes, among other things, an intermediate conductive layer positioned adjacent to and in electrical and thermal communication with the memory element, as well as an insulator component adjacent the intermediate conductive layer.

Brown and Ovshinsky both lack any teaching or suggestion of an electrically erasable programmable memory device that includes a memory element with an intermediate conductive layer of a contact positioned adjacent thereto and in electrical and thermal communication therewith. Rather, Brown teaches a contact pad that is located adjacent to a bond pad, while Ovshinsky teaches that, rather than having contacts adjacent thereto, the adjacent memory elements are bridged by way of an upper conductor 42. Therefore, it is respectfully submitted that claim 39, as proposed to be amended, is allowable over the combination of Brown and Ovshinsky.

Claims 40-44 are each allowable, among other reasons, as depending from claim 39, which should be allowed.

Independent claim 45, as proposed to be amended herein, recites a semiconductor device that includes at least one contact with, among other things, an intermediate conductive layer positioned adjacent to and in electrical and thermal communication with a structure of the semiconductor device that comprises a phase change component.

Neither Brown nor Ovshinsky, taken alone or in combination, teaches or suggests a semiconductor device with a contact that includes an intermediate conductive layer positioned

adjacent to and in electrical and thermal communication with a structure of the semiconductor device that comprises a phase change component. Again, the contact of Brown is disposed against an underlying bond pad or conductive trace, while Ovshinsky teaches a device with memory elements that have an upper conductor 42 adjacent thereto. Therefore, it is respectfully submitted that claim 45, as proposed to be amended, is allowable over the combination of Brown and Ovshinsky.

Claims 46-55 are each allowable, among other reasons, as depending from claim 45, which should be allowed.

Independent claim 56, as proposed to be amended herein, recites an enhanced electrically erasable programmable element with a contact that includes "an intermediate conductive layer positioned adjacent to and in electrical communication with the electrically erasable programmable element; an insulator component disposed adjacent said intermediate conductive layer and over the electrically erasable programmable element so as to insulate same; and an electrically conductive contact layer adjacent said insulator component."

Neither Brown nor Ovshinsky teaches or suggests an enhanced electrically erasable programmable element with a contact that includes an intermediate conductive layer positioned adjacent thereto and in electrical communication therewith. Moreover, neither Brown nor Ovshinsky teaches or suggests placement of a contact with an insulator component over an electrically erasable programmable element so as to insulate the programmable element. Therefore, it is respectfully submitted that claim 56, as proposed to be amended, is allowable over the combination of Brown and Ovshinsky.

Claims 57-67 are each allowable, among other reasons, as depending from claim 56, which should be allowed.

Moreover, it is respectfully submitted that one of ordinary skill in the art, prior to the time at which the referenced application was filed, would not have been motivated to combine the teachings of Brown and Ovshinsky in the manner that has been set forth in the outstanding Office Action to render obvious the subject matter recited in claims 12-20 and 39-55. Specifically, it is

submitted that one of ordinary skill in the art would not have been motivated to combine with a memory element, an electrically erasable programmable element, or any other structure that includes a phase change component, a contact including an intermediate conductive layer, an insulator component, and a contact layer, with the intermediate conductive layer of the contact being positioned adjacent to and in electrical or thermal communication with the memory element or other structure, as is recited in independent claims 12, 39, 45, and 56, as proposed to be amended herein.

While FIG. 4 of Brown depicts a conductive terminal positioned above a corresponding bond pad formed from a different conductive material, and the structure has a similar appearance to that shown in the figures of the referenced application, Brown does not provide any suggestion or motivation that the structure illustrated in FIG. 4 could be used adjacent a memory cell or other structure similar in type to that taught in Ovshinsky.

Furthermore, Ovshinsky, which discloses an EEPROM that includes phase change elements, would also have failed, prior to the time at which the referenced application was filed, to have provided any suggestion or motivation to one of ordinary skill in the art to dispose a contact of a type recited in the claims of the referenced application adjacent to a memory cell or other structure including a phase change component in such a manner that would thermally insulate the phase change element. In fact, Ovshinsky does not even recognize a need for thermally insulating the phase change elements of the EEPROM disclosed therein. Moreover, the figures of Ovshinsky do not depict discrete electrical contacts, such as the exposed contacts of Brown, in communication with each memory element, but rather an encapsulated conductive line that connects adjacent memory elements.

It is further submitted that the knowledge generally available in the art prior to the time the present application was filed would also have failed to provide one of ordinary skill in the art with any suggestion or motivation to combine the teachings of Brown with the teachings of Ovshinsky.

Accordingly, it is respectfully submitted that any motivation to one of ordinary skill in the art to combine the teachings of Brown and Ovshinsky could only be based on the hindsight provided by the disclosure and claims of the referenced application.

For each of the foregoing reasons, it is respectfully submitted that, under 35 U.S.C. § 103(a), each of claims 12-20 and 39-67 is allowable over the combination of Brown and Ovshinsky. It is, therefore, respectfully requested that the section 103(a) rejections of each of these claims be withdrawn.

New Claims

New claims 68-71 have been added. New claims 68 and 69 depend from claim 1, while new claims 70 and 71 depend from claim 32. It is respectfully submitted that none of new claims 68-71 introduces new matter.

New claim 68 recites that at least one of the intermediate conductive layer and the electrically conductive contact layer of the contact of claim 1 abuts the silicon oxide-containing protective layer of the semiconductor device. In addition to being allowable for depending from claim 1, which should be allowed, new claim 68 is allowable since neither Brown nor Ovshinsky, taken alone or in combination, teaches or suggests an intermediate conductive layer or an electrically conductive contact layer that abuts a silicon oxide-containing structure. In fact, the purportedly corresponding layers of the bond pad disclosed in Brown are formed from copper, which, as is well known to those of skill in the art, cannot contact glass since copper reacts with silicon-containing materials in a manner that causes the copper to blister or delaminate from adjacent silicon-containing structures, such as structure formed from a silicon oxide or a glass.

New claim 69 recites that the contacted structure of claim 1, which is located beneath a bond pad-bearing surface of a silicon oxide-containing protective layer, comprises a phase change component. Claim 69 is allowable, among other reasons, as depending from claim 1, which should be allowed.

New claim 70 recites that at least one of the intermediate conductive layer and the contact layer of the contact of claim 32 abuts the silicon oxide-containing protective layer of the semiconductor device. Claim 70 is allowable as depending from claim 32, which should be allowed and, further, because neither Brown nor Ovshinsky, taken alone or in combination, teaches or suggests a semiconductor device with a contact having a conductive layer that contacts a silicon oxide-containing protective layer of the semiconductor device. Again, the contact taught in Brown could not abut a silicon oxide-containing protective layer since the contact of Brown includes conductive layers that are formed from copper.

New claim 71 recites that the contacted structure of claim 32 comprises a phase change component. Claim 71 is allowable, among other reasons, as depending from claim 32, which should be allowed.

CONCLUSION

Claims 1-20 and 32-71 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should it be determined that additional issues remain which might be resolved by a telephone conference, the Office is respectfully invited to contact the undersigned attorney.

Respectfully Submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

A marked-up version of each of the presently amended claims, highlighting the changes thereto, follows:

1. (Twice amended) A contact for a semiconductor device, comprising:

an intermediate conductive layer positioned adjacent to and in electrical communication with a [an underlying] structure located beneath a bond pad-bearing surface of a silicon oxide-containing protective layer of the semiconductor device;

an insulator component positioned adjacent said intermediate conductive layer so as to at least thermally insulate said [underlying] structure; and

an electrically conductive contact layer adjacent said insulator component and in communication with said intermediate conductive layer.

7. (Twice amended) The contact of claim [1] 69, wherein said intermediate conductive layer comprises a material having a melting temperature that is greater than a temperature required to switch a phase change component in electrical communication with the contact between a plurality of states.

12. (Twice amended) A contact for a memory element of a semiconductor device, the memory element including a phase change component, the contact comprising:

an insulator component comprising a thermally and electrically insulative material;

an intermediate conductive layer adjacent said insulator component and adjacent to and in electrical and thermal communication with the memory element [phase change component]; and

a contact layer adjacent said insulator component and in electrical contact with said intermediate conductive layer, said contact layer and said intermediate conductive layer substantially enveloping said insulator component.

32. (Twice amended) A contact for a semiconductor device including a contact layer and an intermediate conductive layer which partially contact one another and substantially envelop an insulator component, the contact being positioned adjacent to a [over an underlying] structure located beneath a bond pad-bearing surface of a silicon oxide-containing protective layer of the semiconductor device so as to at least thermally insulate the [underlying] structure, the contact fabricated by the process comprising:

forming the intermediate conductive layer on a surface of the semiconductor device and in electrical thermal communication with an active device region of the semiconductor device;

depositing a dielectric layer on the intermediate conductive layer;

patterning said dielectric layer to define the insulator component;

forming the contact layer substantially over an exposed area of the insulator component and in electrical communication with the intermediate conductive layer;

patterning the intermediate conductive layer; and

patterning the contact layer.

39. (Twice amended) An electrically erasable programmable memory device, comprising:

a memory element including an electrode adjacent a memory cell, at least one of said electrode and said memory cell comprising a phase change material; and

a contact including an intermediate conductive layer positioned adjacent to and in electrical and thermal communication with said [phase change material] memory element, an insulator component adjacent said intermediate conductive layer, and a contact layer adjacent said insulator component and in electrical communication with said intermediate conductive layer.

45. (Twice amended) A semiconductor device including at least one contact, the at least one contact comprising:

an intermediate conductive layer positioned adjacent to and in electrical and thermal communication with a structure of the semiconductor device comprising a phase change component[of a structure of the semiconductor device];

an insulator component disposed adjacent said intermediate conductive layer; and

a contact layer adjacent said insulator component and in electrical communication with said intermediate conductive layer.

56. (Thrice amended) An enhanced electrically erasable programmable element including a contact comprising:

an intermediate conductive layer positioned adjacent to and in electrical communication with the electrically erasable programmable element;

an insulator component disposed adjacent said intermediate conductive layer and over the electrically erasable programmable element so as to insulate same; and

an electrically conductive contact layer adjacent said insulator component.